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ABSTRACT

This longitudinal field study performed on five female college freshmen attempted to verify a prior pilot study conducted on one subject to compare three verbal, four gesture, and three skill test variables to see which better discriminated between days, thereby providing the researcher a clearer picture of the subjects' changes during learning. Subjects were filmed over four daily one-half hour sessions by a professional team. Sixty tennis serves per subject (15 per day) were randomly selected for the analyses. Direct and RAO's discriminant analyses from SPSS using "day" as the group variable selected three gesture, one verbal, and one skill variable. Using these five variables, 39 percent of the serves were correctly classified. Compared to the pilot study, five instead of seven variables were selected. All the gesture variables were selected both times. One instead of three verbal variables were selected. Form took the place of speed among skill variables. Since gesture data were the most consistently discriminating, motor learning researchers should include gesture along with skill test and verbal data when studying the learner the first days of learning a complex motor skill. (Author)

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STUDY II: COMPARISON OF VERBAL, GESTURE AND SKILL DATA OBSERVED IN COMPLEX MOTOR SKILL ACQUISITION

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ABSTRACT

This longitudinal field study performed on five female college freshmen attempted to verify a prior pilot study conducted on one subject to compare three verbal, four gesture, and three skill test variables to see which better discriminated between days, thereby providing the researcher a clearer picture of subjects' changes during learning. Subjects were filmed over four daily one-half hour sessions by a professional team. The data were separately transcribed, coded, and analyzed over a 15-year period. Sixty serves per subject (15 per day) were randomly selected for the analyses. Direct and Rao's discriminant analyses from SPSS using day as the grouping variable selected three gesture, one verbal, and one skill variable. Using these five variables, 39% of the serves were correctly classified. Compared to the pilot study, five instead of seven variables were selected. All the gesture variables were selected both times. One instead of three verbal variables were selected. Form took the place of speed among skill variables. Since gesture data were the most consistently discriminating, motor learning researchers should include gesture along with skill test and verbal data when studying the learner the first days of learning a complex motor skill.

Study II: Comparison of Verbal, Gesture, and Skill Data Observed in Complex Motor Skill Acquisition

Past research has found subjects' skill performance too inconsistent to explain what is occurring during the early learning phase of a complex motor skill due to the presence of other factors (Fleishman, 1956; Lindquist, 1983). However, researchers in the past have relied almost totally on inconsistent skill test data to determine whether or not learning has occurred.

Lindquist (1983) conducted a pilot study to determine specific types of data to collect and statistical treatments to use when studying learning over time in the field. Gesture, verbal, and skill performance variables were compared using Pearson's correlation, contingency table analyses, and RAO's discriminant analyses from SPSS (Nie, Hull, Jenkins, Steinbrenner, and Bent, 1975). One paid freshman college woman subject, a naive tennis player who served 277 serves over four days was employed. Detailed procedures are found in Lindquist (1983). The labels and descriptions for the 10 variables appear in Tables 1, 2, and 3.

Insert Tables 1, 2, and 3 about here

Discriminant analyses resulted in all four gesture variables, one skill test variable (speed), and all three verbal variables included in the stepwise analysis (see Table 4, column 2 for the stepwise order). The skill tests (serve accuracy and form) were

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Insert Table 4 about here

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eliminated as not contributing further to the discrimination between days. The remaining variables resulted in correctly classifying 53.4% of the cases.

Only two of the variables were reasonably highly correlated: verbal and items (r = .79, p = .001) and provided no further information. The nonmetric chi square analysis (which might be more suitable than discrimination analysis for this level of data but limited to the number of variables that can be included in the same analysis) resulted in significant chi squares including Form (χ^2 = 48.68, p = .000). This inclusion of Form was the only difference between the results of the separate chi square and discriminant analyses. Discriminant analysis, however, produced the valuable additional stepwise elimination of variables that contributed no further to discriminating between days. Discriminant analysis would, therefore, be preferred to chi square analysis due to time saved in single table analysis, ability to analyze multiple factors in the same analysis, and more information provided.

The purpose of this present study was to see if the results from this pilot study would hold if more subjects were analyzed.

Methodology

The data for five subjects were collected on television tape by a professional crew as described in Lindquist (1968, 1971) and consisted of four one-half hour learning sessions. The number of serves per day per subject can be seen in Table 5.

Insert Table 5 about here

All 10 variables for all serves were analyzed. Due to the large amount of data (1747 serves times 10 variables equalling 17,470 variables), a random sample of 15 serves per day per subject was selected resulting in using 300 serves per subject (a 17% sample).

Data Analysis

Direct and Rao's V discriminant analyses (Nie et all, 1975) were used to analyze the data. The former to see how using all the variables would discriminate between days and the latter to see which variables were the best discriminators.

Results

Table 6 shows the Wilks Lambda and univariate F-ratio analysis for each of the variables.

Insert Table 6 about here

Table 7 shows the variables selected in the Rao's stepwise discriminant analysis.

Insert Table 7 about here

The following variables were not selected: DIFFS (gesture), ACC (skill), Speed (skill), and Verbal. Using these selected variables, 39.67% of the cases were correctly classified; using all the variables in the direct discriminant analysis, 43% of all the variables were correctly classified.

Table 8 shows the comparison between the variables selected from the pilot study with those in the present study. The pilot study narrowed the selection of variables from 10 to 8; the present study further reduced the selection to 5.

Discussion and Conclusions

The difference between the results of Study I and Study II may be due to the selection procedure: all serves were used in the pilot study and a random selection of serves used in Study II. Differences unique to the pilot subject may have been eliminated by using more subjects. A great difference can be seen between number of serves per day.

Although Form was used in this study as a skill variable, it may be closer to being a gesture variable in that the analysis is made by an observer. The gesture variable DIFFS had a significant

F, $F(3, 296) = 2.7$, $p = .0459$, but was not selected as further contributing to discriminating between days; it probably was the variable that contributed to a larger percentage of cases being correctly classified with the direct discriminant analysis.

Most of the researchers in body language feel that gesture data are more indicative of an individual's thoughts and feelings than verbal data (Birdwhistell, 1970; Fast, 1970). This study shows all gesture data to reflect changes between days and gesture data may be better indicators of early complex skill learning than verbal and skill data. Each variable should be further analyzed to determine what it reveals.

The replacement of speed of serve with form is due to form being a more consistent variable than speed and a more suitable variable to use at this stage of learning.

In summary, researchers should include gesture and verbal data in studying complex motor skill learning in the field to determine if changes in behavior are occurring. Although these changes may be more difficult to see in large groups, they are present and observable. Cognitive changes (reflected in verbalization and gesture) apparently precede skill changes and are, consequently, worthy of study. Unfortunately, physical educators have spent little time studying these changes.

References

Birdwhistell, R. L. (1970). Kinesics and Context. Philadelphia: University of Pennsylvania Press.

Fast, J. (1970). Body Language. Philadelphia: J. B. Lippincott.

Fleishman, E. A., & Hempel, W. E. (1956). Factorial analysis of complex psychomotor performance. Journal of Applied Psychology, 40, 96-104.

Lindquist, E. L. (1968). An information processing approach to the study of a complex motor skill. Dissertation Abstracts International, 1003A. (University Microfilms No. 69-12,170).

Lindquist, E. L. (1971). Study of the cognitive plan in the acquisition of complex motor skill. Continuation of study I: Good motor learners. U. S. Department of Health, Education, and Welfare. (ERIC Document Reproduction Service No. RMQ66004, BR-9-I-107, April 1971 EDRS).

Lindquist, E. L. (1983). Comparison of verbal, gesture, and skill data observed in complex motor skill acquisition. Paper presented at the Conference of the California Alliance for Health, Physical Education, Recreation and Dance, April 16, 1983. (ERIC Document Reproduction Service No. ED 231 798).

Nie, N. H., Hull, C. H., Jenkins, J. G., Steinbrenner, K., & Bent, D. H. (1975). SPSS: Statistical package for the social sciences (2nd ed.). New York: McGraw-Hill.

Table 1

Verbal data	f
Verbal Part	
1. Goal data (accuracy, speed)	84
2. Ball toss	79
3. Position of racket face	40
4. Wrist, grip, spin	39
5. Contact problems	14
6. Rhythm, timing	11
7. Backswing, swing	7
8. Body position, court position	3
Value	
1. Accept	21
2. Uncertain	37
3. Questionable	5
4. Reject	214

Table 1 -- continued Verbal data

Items (number referenced per serve)	f
0	3
1	151
2	102
3	12
4	2
5	7

Table 2

Gesture Data

Code	Part Involved	Absolute f
1.	Hand	0
2.	Foot	0
3.	Face-head	170
4.	Arm	25
5.	Leg	4
6.	Shoulder	0
7.	Back	0
8.	Abdominal-hip	1
9.	Whole body	73
10.	Missing	1

Code	Size of Gesture	Absolute f
1.	Small	213
2.	Medium	37
3..	Large	26
4.	Missing	1

Code	Type of Gesture	Absolute f
1.	Accepting	22
2.	Uncertain	30
3.	Questionable	1
4.	Rejecting	224

n. of different Gestures	Absolute f
0	1
1	194
2	63
3	15
4	3
6	1

Table 3

Skill Test and Form Scores

Accuracy		Speed	
Score	Absolute f	Score	Absolute f
0	215	0	217
1	11	1	6
2	40	2	32
3	5	3	22
4	1	4	0
5	2		
6	3		

Form

Category Code	Scores in Category	Absolute f
1	1-29	5
2	30-35	25
3	36-41	59
4	42-47	96
5	48-53	82
6	54-59	10

Table 4

Rao's V Stepwise Discriminant Analysis of Pilot Subject

Step	Variable Entered	Rao's V F to remove	Wilks' Lambda	Rao's V	Change in Rao's V	p
1	Part	15.973	0.849*	47.925	47.93	0.00
2	Type	20.016	0.693*	115.771	67.05	0.00
3	Verbal	18.016	0.577*	182.631	66.86	0.00
4	Size	7.617	0.531*	217.476	34.84	0.00
5	Diffs	7.418	0.490*	250.682	33.21	0.00
6	Items	5.813	0.460*	271.013	20.33	0.00
7	Value	1.450	0.452*	276.400	5.48	0.14
8	Spd	1.411	0.445*	282.816	6.33	0.097

*p > .0001

Table 5

Number of Serves per Subject by Day

	Day				Total
Subject	1	2	3	4	
1	44	110	77	100	331
2	52	37	94	114	397
3	57	91	77	135	360
4	94	72	58	62	286
5	68	114	94	97	373
				TOTAL	1747

Table 6

Wilks' Lambda (V-Statistic) and Univariate F-ratio for all Variables

Variable	Type of data*	Wilks' Lambda	F(3,296)	p
Part	G	.950	5.202	0.0016**
Type	G	.973	2.708	0.0455**
Size	G	.975	2.519	0.0582**
Diffs	G	.973	2.700	0.0459**
Acc	S	.998	.232	0.8740
Spd	S	.990	.950	0.4167
Form	S	.902	10.700	0.0000**
Value	V	.964	3.666	0.0128**
Verbal	V	.990	.918	0.4325
Items	V	.981	1.835	0.1409

*G = gesture, S = Skill, V - Verbal

** p = .05

Table 7

Summary Table of Rao's V Discriminant Analysis

Step	Variable	Type of Data*	Wilks' Lambda	Rao's V	Change in V	p
1	Form	S	.90**	32.11**	32.11	.000
2	Part	G	.87**	45.22**	13.11	.004
3	Value	V	.84**	55.78**	10.56	.014
4	Type	G	.82**	62.96**	7.18	.066
5	Size	G	.81**	67.67**	4.71	.194

*G = Gesture, S = Skill, V = Verbal

**p < .0001

Table 8

Variables Accepted and Not Accepted in Discriminant Analysis

Variables Accepted			
Study I: Pilot Study		Study II	
Variable	Type of data*	Variable	Type of data*
Part	G	Form	S
Type	G	Part	G
Size	G	Value	V
Diffs	G	Type	G
Speed	S	Size	G
Value	V		
Verbal	V		
Items	V		
Variables not Accepted			
Form	S	Diffs	G
Acc	S	Acc	S
		Speed	S
		Verbal	V
		Items	V

*G = Gesture, S = Skill, V = Verbal